Published for SISSA by Springer
Received: September 5, 2016
Accepted: September 5, 2016
Published: September 8, 2016

Erratum: Physics from solar neutrinos in dark matter direct detection experiments

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Erratum to: JHEP05(2016)118

Abstract: We correct 1) missing factors of 2 in cross section expressions in table 4 of the published article; and 2) the LUX bound in figure 6 on the B-L coupling from 2015 data, which displayed erroneously strong constraints due to a computer error. Conclusions remain unchanged.

ArXiv ePrint: 1604.01025

doi:10.1007/JHEP09(2016)048

JHEP09(2016)048

Mediator	$\mathcal{L}$	$d\sigma_e/dE_R - d\sigma_e^{\rm SM}/dE_R$	$d\sigma_N/dE_R - d\sigma_N^{\rm SM}/dE_R$
Scalar	$(g_{\nu,\phi}\,\phi\bar{\nu}_R\nu_L + h.c.)$ $+\,\phi\bar{\ell}g_{\ell,s}\ell + \phi\bar{q}g_{q,s}q$	$\frac{g_{\nu,\phi}^2 g_{e,s}^2 E_R m_e^2}{4\pi E_\nu^2\left(2E_R m_e + m_\phi^2\right)^2}$	$\frac{Q_s'^2 m_N^2 E_R}{4\pi E_\nu^2\left(2E_R m_N + m_\phi^2\right)^2}$
Pseudoscalar	$(g_{\nu,\phi}\,\phi\bar{\nu}_R\nu_L + h.c.)$ $-i\gamma^5\phi\bar{\ell}g_{\ell,p}\ell - i\gamma^5\phi\bar{q}g_{q,p}q$	$\frac{g_{\nu,\phi}^2 g_{e,p}^2 E_R^2 m_e}{8\pi E_\nu^2\left(2E_R m_e + m_\phi^2\right)^2}$	0
Vector	$g_{\nu,Z'}Z'_\mu\bar{\nu}_L\gamma^\mu\nu_L$ $+\ Z'_\mu\bar{\ell}\gamma^\mu g_{\ell,v}\ell\ +$ $Z'_\mu\bar{q}\gamma^\mu g_{q,v}q$	$\frac{\sqrt{2}G_F m_e g_v g_{\nu,Z'} g_{e,v}}{\pi\left(2E_R m_e + m_{Z'}^2\right)}$ $+\frac{m_e g_{\nu,Z'}^2 g_{e,v}^2}{2\pi\left(2E_R m_e + m_{Z'}^2\right)^2}$	$-\frac{G_F m_N Q_v Q'_v (2E_\nu^2 - E_R m_N)}{2\sqrt{2}\pi E_\nu^2\left(2E_R m_N + m_{Z'}^2\right)}$ $+\frac{Q_v'^2 m_N (2E_\nu^2 - E_R m_N)}{4\pi E_\nu^2\left(2E_R m_N + m_{Z'}^2\right)^2}$
Axial Vector	$g_{\nu,Z'}Z'_\mu\bar{\nu}_L\gamma^\mu\nu_L$ $-\,Z'_\mu\bar{\ell}\gamma^\mu g_{\ell,a}\gamma^5\ell$ $-\,Z'_\mu\bar{q}\gamma^\mu g_{q,a}\gamma^5 q$	$\frac{\sqrt{2}G_F m_e g_a g_{e,a} g_{\nu,Z'}}{\pi\left(2E_R m_e + m_{Z'}^2\right)}$ $+\frac{m_e g_{\nu,Z'}^2 g_{e,a}^2}{2\pi\left(2E_R m_e + m_{Z'}^2\right)^2}$	$\frac{G_F m_N Q_a Q'_a (2E_\nu^2 + m_N E_R)}{2\sqrt{2}\pi E_\nu^2\left(2E_R m_N + m_{Z'}^2\right)}$ $-\frac{G_F m_N Q_v Q'_a E_\nu E_R}{\sqrt{2}\pi E_\nu^2\left(2E_R m_N + m_{Z'}^2\right)}$ $+\frac{Q_a'^2 m_N (2E_\nu^2 + E_R m_N)}{4\pi E_\nu^2\left(2E_R m_N + m_{Z'}^2\right)^2}$

Table 4. New Lagrangian terms and differential cross sections with the nucleus N and electron e for the four types of new mediator we consider. Note the negative interference in the vector and axial case with the SM contribution.

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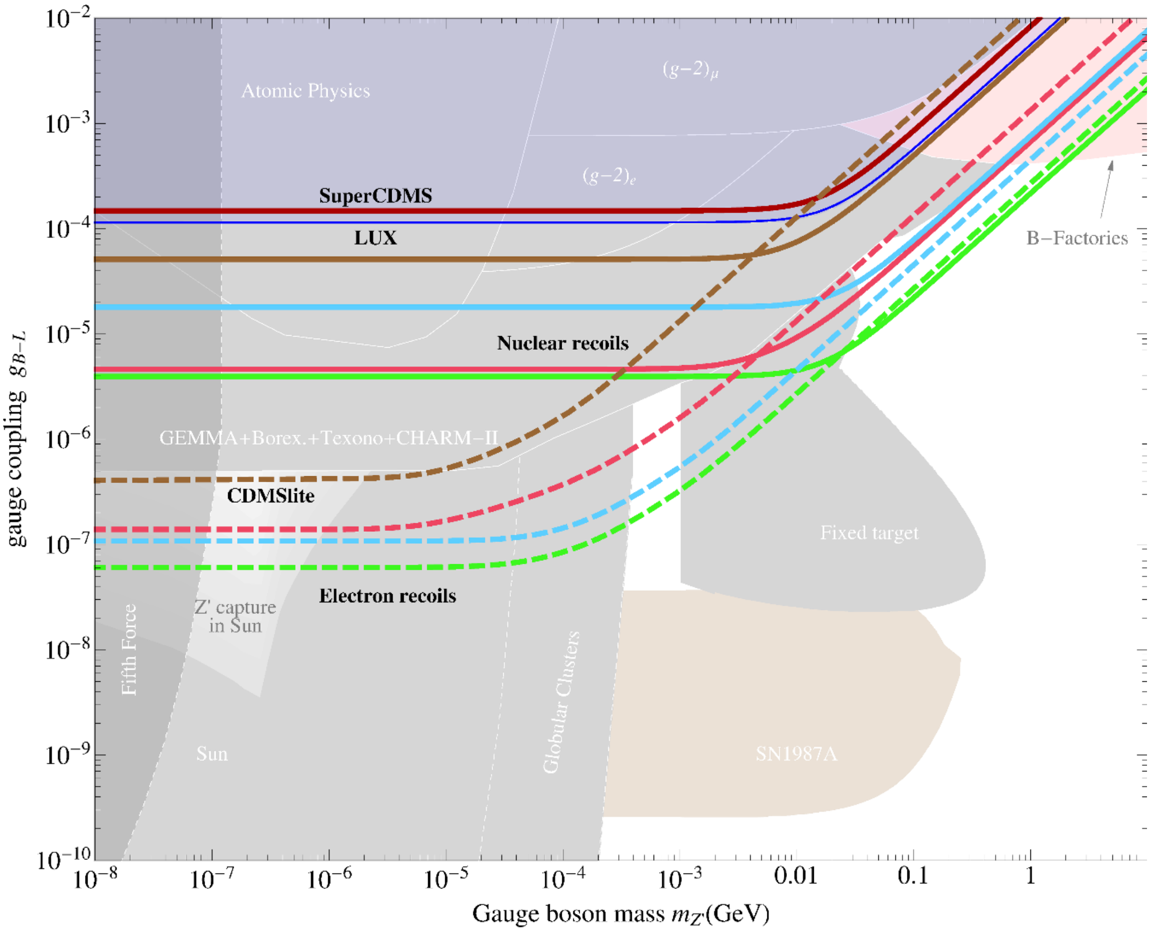

Figure 6. Projected 90% CL constraints on the B-L model for nuclear recoils (solid lines) and electron recoils (dashed) in the optimistic scenarios for G2 germanium (red), G2 xenon (blue) and future xenon (green). We also show approximate bounds derived from the current SuperCDMS (red line), CDMSlite (brown solid and dashed lines), and LUX data (blue shaded region). Our bounds are overlaid on existing constraints. To translate these bounds to the other possible scenarios, one should keep in mind that some bounds (intermediate grey) only apply when the new mediator couples to leptons. The supernova bound (brown) only applies to couplings to baryons, while B-factory bounds (pink) require both. The fifth force constraint (dark grey) applies in either case. The grey regions, the neutrino scattering bound and the pink pregion, and the supernova limits are respectively taken from refs. [1, 2], and [3].

Acknowledgments

We thank James Dent for pointing out the mistakes in table 4.

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